WATER SENSOR
BE A WATER SPECIALIST
Instruction Sheet

We have smoke detectors and carbon monoxide detectors in our homes, schools, and business, why not a water contamination detector? Imagine being able to continuously monitor the quality of your drinking water and being alerted if the water becomes unsafe to drink. This may be possible by using sensors and Artificial Intelligence (AI). In this activity, you will learn more then make your own water computer program to help detect water turbidity, how cloudy water is.

Image Source: Argonne

MATERIALS

Ask permission from a parent or guardian before gathering materials:

- ☐ 3 or more clear cups/containers that can hold water
- ☐ Water
- ☐ Print out or black marker and white paper
- ☐ Scissors
- ☐ Soil/dirt or Flour
- ☐ Device with camera (laptop, tablet, smart phone)
- ☐ Machine Learning for Kids

Photo by Mark Lopez/Argonne National Laboratory

INTRODUCTION

Access to clean safe water is a major issue around the world. Even in areas where there are large bodies of freshwater, like cities that surround the Great Lakes. Lead, chemicals, pollution and microplastics (really small pieces of plastics) are threats to clean accessible water. There are different measurements to detemrine if water is safe or not. It could be how much of a certain substance (like lead) is in the water. You can also measure water by it's turbidity—how cloudy it is. At extremely high levels, you may be able to tell if water is polluted or unsafe water just by looking at it, but often times, water may look safe to drink, even when polluted because the particles are so small. This where computers and sensors can come in and help us.

Scientist have developed sensors and used artificial intelligence to solve some of the world's water problems. Scientists create parameters of what clean water is and what polluted water is. Then, the sensor checks the water based on those paramters. Sensors can continuously monitor water quality and safety conditions, even conditions not visibile to the naked eye. The computer program that runs the sensors would also be constantly updating and learning more--taking some of that maintenance burden off us and could also be used to make predictions for the future condition of the water source.

Although we can't build those types of sensors at home, we can do something similar. In this activity, you will be developing your own water turbidty-sensor program via Machine Learning for Kids.Your goal will to be create a computer program that can correclty detect and classify the turbidity levels of water using a webcamera.

ACTIVITY HIGHLIGHTS

- ☐ **Learn how artificial intelligence (AI) can be used to monitor water quality**

- ☐ **Learn about water turbidity—how cloudy water is, and how we can measure it at home**

- ☐ **Create your own AI program to turbidity**

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WATER SENSOR
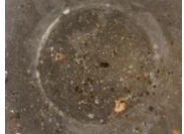## BE A WATER SPECIALIST
Data Sheet

PROCESS / PROCEDURE STEPS

1. Gather cups.

2. Print out or draw and cut out secchi disk for each of your cups.

3. Tape secchi disk to bottom of your cup. Note: secchi disk can be the same diamater (size) of the bottom of your cup or smaller)

4. Pour clean water into 8oz of water into each cup

5. Place one cup a side as this will be the very clear/lowest turbidity

6. For each of the remaining cups add the following amounts:

   Cup 2: 1/8 teaspoon of flour or soil

   Cup 3: 1/4 teaspons of flour or soil

Note: You may need to adjust amounts of soil/flour to water depending on the brand or type you use. Essentially you need to have 3 categories, low (clear), medium (blurry) and high (unable to see secchi disk).
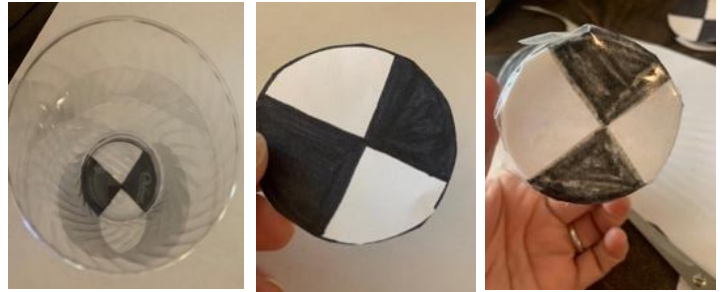
Low	Medium	High

7. On your device, go to Machine Learning for Kids: https://machinelearningforkids.co.uk/

8. You can sign is as a guest or create an account. Note that if you are a guest user you will only be able to work on it for a few hours. If you create an account you wil be able to save and return to work on it later.

9. Create a project. Give your project a title and select images

10. Select "train your program".

11. Create three "buckets"—high, medium, and low.

12. Take 6 photos for each category using your webcam. Rotate the cup for each new picture so you have multiple (6) angles/positions.

13. Once you have 6 photos in each category, go back and select "Learn & Test".

14. Click "Train new machine learning model"

15. Once it is doen training, you will be able to test out your project.

16. Make a new mixture using a new cup, water, and dirt/flour or go collect a real water sample from a puddle.

17. Once you have new smaples ready, click "test with webcam"

18. Take a picture and see how correctly your program was able to categorize it. Note if your program was correct or incorrect and the level of confidence.

19. Reflect: How can you improve your model? What should be consistent when take photos? Do you need to add more images to train your model to be more accurate? How does lighting, shadow and reflections play a role?